VALID UNTIL 5/4/07

APPENDIX 12 – ZERO-EMISSION TECHNOLOGIES

Below is additional information pertaining to the Zero-Emission Technologies category under AQMD's FY 2007 Carl Moyer Program (CMP). All information in PA #2007-08 and this Appendix apply. For additional detail regarding this program category, refer to CARB's 2005 CMP Guidelines. In the case of any conflict between CARB guidelines and AQMD criteria, the more stringent criteria will prevail. In addition, CARB staff has issued a CMP Advisory (#06-002) that includes corrections to Chapter 12 of the Moyer guidelines .

It is the Applicant's responsibility to check with AQMD's CMP web page for program clarifications, changes and updates. This page may be accessed at http://www.aqmd.gov/tao/implementation/carl_moyer_program_2001.html.

This Appendix highlights some of the available zero-emission technologies eligible for Carl Moyer Program funding. It provides more detail on zero-emission technologies and, for some project types, provides additional project criteria. It also describes emission reduction and cost-effectiveness calculation methodologies. This Appendix is a supplement to other Appendices in these Guidelines: it does not replace or supersede any other criteria.

CARB MOYER PROGRAM RESOURCES

Applicants are highly encouraged to review CARB guidelines for additional requirements of the CMP. CARB guidelines are incorporated into AQMD's Moyer Program by reference. 2005 CARB guidelines may be downloaded from:

http://www.arb.ca.gov/msprog/moyer/guidelines/revisions05.htm

On this web page, there are links to the four parts of the CARB 2005 CMP guidelines. These parts are described below for easy reference.

- Part I provides the Executive Summary, Program Overview and Administrative Requirements (primarily applicable to air districts) for CARB's Carl Moyer Program. The link to Part I is http://www.arb.ca.gov/msprog/moyer/guidelines/2005_Carl_Moyer_Guidelines_Part1.pdf

- Part II provides the Project Criteria for each program category. The link to Part II is http://www.arb.ca.gov/msprog/moyer/guidelines/2005_Carl_Moyer_Guidelines_Part2.pdf

- Part III provides the Agricultural Assistance Program guidelines. Link to Part III at http://www.arb.ca.gov/msprog/moyer/guidelines/2005_Carl_Moyer_Guidelines_Part3.pdf

- Part IV is the Appendices section of the guidelines. The link to Part IV is http://www.arb.ca.gov/msprog/moyer/guidelines/2005_Carl_Moyer_Guidelines_Part4.pdf . This section includes the following Appendices.

    - Appendix A – Acronyms
    - Appendix B – Tables for Emission Reduction and Cost-Effectiveness Calculations
    - Appendix C – Cost-Effectiveness Calculation Methodology
    - Appendix D – Example Calculations
    - Appendix E – Description of Certification and Verification Executive Orders
    - Appendix F – Retrofit Emission Control Strategies
    - Appendix G – Description of Functional Equivalency of Non-Original Equipment Manufacturer Repowers and Rebuilt Engines for use in Repowers

The CMP Advisory 06-002 that contains corrections to Chapter 12 – Zero-Emission Technologies may be found at http://www.arb.ca.gov/msprog/moyer/advisories_005/advisories_005.htm

HIGHLIGHTS FOR 2007

Criteria for most projects are found in the respective Appendices pertaining to the category of equipment under consideration. All relevant regulations and MOUs discussed or referred to in the respective appendices also apply to zero-emission projects. The only difference is that the new or replacement piece of equipment has no emissions.

Many of the zero emission technology projects will be assessed on a case-by-case basis at this time,. As with all projects, emission reductions must be surplus, real, quantifiable, and enforceable. Zero emission technology projects must meet a cost-effectiveness threshold of $5,000 per weighted ton. An exception is forklifts. Forklifts with a lift capacity of 3,000 to 6,000 pound have a cost-effectiveness threshold of $7,000 per weighted ton while forklifts with a lift capacity over 6,000 pounds have a cost-effectiveness threshold of $14,300 per weighted ton.

I. Regulatory Requirements

A number of CARB regulations affect the baseline equipment against which zero emission technologies are evaluated. These are included in the respective appendices pertaining to the category of equipment under consideration. Applicants need to ensure that they are in full compliance with any applicable CARB regulations and determine that the incremental emission reductions from zero emission technologies are in fact surplus.

III. Potential Zero-Emission Projects

A. Electrically-Driven Agricultural Equipment

Agricultural equipment, such as pumps, provide an ideal application and the potential for wide-scale deployment of a zero-emission technology.

A new utility company incentive program coupled with Carl Moyer Program funding provides an opportunity to go electric. Pacific Gas and Electric (PG&E) and Southern California Edison (SCE) have developed a rate-based incentive program that helps make electric motor irrigation pumps cost-competitive with diesel pumps. T The PG&E and SCE incentive programs are first-come-first-served programs that are accepting applications through July 31, 2007. Applicants must obtain prior approval from the district before purchasing an electric motor under the PG&E and SCE incentive programs.

Project Criteria for Electrically Driven Agricultural Equipment

- Purchases of new 2005 or later model year agricultural equipment can only be electric motors.
- Priority must be given to projects that replace stationary agricultural engines with electric motors.
- Agricultural equipment that use an electric motor may use a default 10 year project life for calculating cost-effectiveness.
- Costs for necessary peripheral equipment associated with the motor (e.g., control panel, motor leads, service pole with guy wire, and connecting electric line) may be included in the grant award amount.
- District match funds may be used for infrastructure purchase and installation.
- District match funds may be used to offset the higher cost of electricity relative to diesel fuel, if applicable. In this case, the fuel cost difference will be accounted for when calculating the cost-effectiveness of the project.
- All electric-driven equipment must have a functioning kilowatt-hour meter, or other method approved by the local air district, to monitor usage.

B. Marine Shore-Side Provided Power

In addition to being the largest source of air pollution in many districts, ports are often situated in environmental justice areas. For these reasons, ports are a primary focus for emission reduction strategies throughout the state.

The largest emission source at ports is marine vessels. One strategy for reducing

marine vessel emissions is “cold ironing” where ships plug into shore-side power while docked, rather than continuously running their diesel engines to generate electricity. Cold-ironing requires the proper electrical supply connections from the shore — lines, transformers, switching gear, cables, etc. — and the necessary hook-ups on the ship.

Cold ironing, long used for naval vessels, has recently been implemented in the non-military sector in Juneau, Alaska and at the Port of Los Angeles. In addition, the Port of Long Beach has begun work to provide dockside electricity to accommodate two retrofitted oil tankers and work has begun in Seattle to convert a berth for cruise ships. Other ports in the U.S. and worldwide are also considering cold-ironing. Early results of ARB’s shore-electrification feasibility study indicate that cold-ironing is a cost-effective measure to reduce pollutants from a variety of ships — namely, cruise ships, container ships, and refrigerated bulk ships — at several California ports.

Most marine projects in the Carl Moyer Program deal with harbor craft. Cold ironing projects go beyond harbor craft and include cruise ships, tankers, and freighters. Because cold ironing is a nascent technology, it is difficult to specifically identify the exact components that will be eligible for Carl Moyer Program funding. Because each cold ironing project will be unique, ARB staff is proposing that they be considered for grant funding on a case-by-case basis. The cost-effectiveness and grant amount will depend on a number of issues such as interface compatibility, operating voltage, energy needs and electricity availability at the dock. However, evidence must be submitted to the air district to prove that all emission reductions are surplus, real, quantifiable, and enforceable and the cost-effectiveness limit is not exceeded**.** Applications will be evaluated based on factors including, but not limited to, frequency and duration of port visitations, energy usage at the dock, seasonal operating variances and regularity of travel routes.

C. Forklifts and Other Large Spark-Ignition Equipment

The Carl Moyer Program has two general emission control strategies for forklifts -- (1) purchase of new electric forklifts instead of new internal combustion engine (ICE) forklifts; and (2) retrofit or repower of internal combustion forklifts that do not lend themselves to electric substitution. CARB is considering regulations for large spark-ignition (LSI) equipment, including forklifts, in the next year. Once the Board has approved any proposed regulations, CARB staff will provide specific criteria for the LSI Off-Road Category through a technical advisory approved by the Executive Officer,

The following changes regarding electric forklift projects:

- The cost-effectiveness limit for electric forklifts with a lift capacity of 3,000 pounds to 6,000 pounds is $7,000 per weighted ton
- Leased forklifts are eligible for funding if the lease term is three years or more.

Appendix Six provides additional background discussion on this project category and potential criteria that could be used to establish funding eligibility under the Carl Moyer Program for both strategies. Staff is proposing that until the Board adopts the LSI regulation, districts may continue to fund forklift projects using the 2003 Carl Moyer Program Guidelines. During this interim period, additional zero-emission LSI projects

may be considered on a case-by-case basis.

D. Airport Ground Support Equipment

Electric GSE have several attributes that make them appeal to users. Participants of demonstration and fleet conversion programs like the way that electric GSE handle and appreciate the fact that they are more “task specific”. Battery weight often provides valuable ballast needed to lift heavy objects or push airplanes; usage is often conducive to charging cycles; there are no odors; and no liquid fuel required in the aircraft staging area. Most importantly, electric GSE can be cost-effective and generally have relatively short payback periods. Electric GSE are commercially available and commonly used for a number of equipment types including belt loaders, baggage tractors, aircraft tugs, lifts, ground power units, cargo loaders, lavatory carts and air-start units. However, the higher capital cost of electric equipment is often a deterrent to prospective buyers. Carl Moyer Program funds can be used to offset this initial capital investment.

The Carl Moyer Program will fund the purchase of new electric GSE instead of new GSE powered by internal combustion engines if this equipment is not used to meet the requirements of any regulation, including the upcoming large-spark ignition regulation; is not funded through any other incentive program; and is not used to generate credits of any type.

E. Idling Reduction Technologies

Truck drivers idle their propulsion engines for a number of reasons but the main purpose is for interior climate control --heating and cooling the cab/sleeper compartment of the truck.

Idling emissions, as well as fuel consumption, can be reduced by installing an available zero-emission idling control technology such as an on-board non-internal combustion engine device; by using a site-specific off-vehicle technology such as IdleAire; or by combining on and off-vehicle technologies.

Available zero-emission on-vehicle technologies include generators or upgraded alternators coupled with inverter/chargers and electric heating ventilation and air conditioning (HVAC) systems. On-board battery packs or fuel cells are also an option.

Off-vehicle technologies include grid-supplied electricity at truck stops and advanced truck stop electrification (e.g., IdleAire). The use of these devices, in lieu of operating the heavy-duty engine at idle, will result in significant NOx reductions. Reductions in PM and ROG are also expected but to a lesser extent depending on the type of alternative idle reduction device/strategy used.

In October 2005, the Board will consider a proposal that would limit idling of heavy duty trucks equipped with sleeper berths. This proposal would prohibit heavy duty trucks with sleeper berths from idling more than five minutes unless certain conditions are met. If the Board approves the staff recommendations, the baseline for calculating the benefits of truck idle reduction projects would be a certified diesel APU. Zero-emission technologies would be eligible for funding using the lower emission baseline.

1. Idling Reduction Technology Options

Because the vast majority of truck idling occurs away from truck stops, the most

effective idle reduction technologies are those that are available to meet operator needs at any location idling occurs. The costs of these technologies vary widely, although the initial capital investment can typically be recovered within one to three years from reduced fuel and maintenance savings. Still, truck owners and operators have not been receptive to these solutions because of their higher initial cost.

Another on-board idle reduction system utilizes electric heating, ventilation, and air conditioning (HVACs) instead of internal combustion engine-driven HVACs. These electric HVACs can be powered directly from the grid, a fuel cell, or from energy stored in battery packs. The battery packs can be charged from the grid, from the truck's alternator, or from a small on-board gen-set. Fuel cells are an emerging zero-emission technology that may also substitute for idling truck engines or auxiliary power units in the future.

ARB staff proposes to continue to help defray the initial cost of equipping the truck with the necessary idle-reducing electric equipment. The Carl Moyer Program would pay up to $5,500 toward electric equipment and up to $3,400 for its installation. In order to be eligible for funding, 75 percent of the applicant's usage must take place within California.

2. Truck Stop Electrification

Installation of electric power infrastructure at truck stops, or truck stop electrification (TSE), is gaining support as an idling reduction strategy. Under this option, trucks would be provided with 110 volt alternating current (AC) electrical power at truck stops to run the electric air conditioning, heating and onboard appliances. The electric supply can also be used to charge on-board batteries for electricity use away from the truck stop. Truck stops would need to be equipped with electrical outlets throughout the parking spaces and trucks would need to be equipped, at a minimum, with inverter/chargers and electrical power connections. If fitted with batteries, the truck could use electricity away from the truck stop. The inverter/charger is used to charge the truck batteries and to convert the truck's 12 volt direct current (DC) batteries to 120 volt AC power for all onboard appliances. Currently, AC power inverters that are built into the truck are offered as a factory option by Freightliner, Volvo and International. The cost for inverter/chargers is approximately $1,400, and a 600-700 Ah lead acid battery pack (good for about 8-15 hours of HVAC and appliance operation) costs approximately $8,000.

As discussed above, the Carl Moyer Program would pay up to $5,500 toward electric equipment on-board the truck and up to $3,400 for its installation. TSE infrastructure installation at truck stops costs approximately $2,000 per truck parking space. District matching funds may be used to offset this cost.

3. Advanced Truck Stop Electrification

An alternative to the TSE system that does not need truck modifications has been introduced by IdleAire Technologies. This system provides heating and air conditioning to the truck, as well as electrical power for on-board appliances. It also provides basic services such as telephone and internet access and cable or satellite television. The unit is connected to the truck through a console mounted to the truck window using a

template insert. The console contains all the necessary connections and controls, including a card reader for the billing system. The infrastructure cost is approximately $17,000 per parking space but may vary depending on the number of parking spaces installed.

Several advanced truck stop electrification projects have been installed with state and local funding. Staff is proposing to allow Carl Moyer Program funds to be used for installing advanced truck stop electrification systems (e.g., IdleAire systems). In these cases, a partial payment would be made upfront to help offset the initial capital investment. The remainder of the grant amount would be paid out in installments based on system utilization. The amount of the initial payment and subsequent installments will be determined on a case-by-case basis.

The truck idling reduction projects described are just a few of many zero-emission idle reduction strategies. Other technologies and projects may also be eligible for Carl Moyer Program funding on a case-by-case basis. As with all projects, emission reductions must be surplus, real, quantifiable, and enforceable and the project must meet the cost-effectiveness threshold of $5,000 per weighted ton of emission reductions.

F. Transportation Refrigeration Units

Electric standby transportation refrigeration units allow the engine to be turned off when a compatible electric power supply is available to operate the transportation refrigeration unit (TRU). Diesel engine emissions are eliminated while the TRU is plugged in at the facility. TRU manufacturers currently offer an electric standby option on most models but very few trucks operating in the United States – less than one percent of trucks with TRUs – opt for these units. Electric standby TRU models are common in Europe where approximately 90 percent of all truck TRUs have some type of electricity plug-in capability. As currently designed, however, the electric motors are only sized to hold a temperature set point and may not have sufficient power to pre-cool large trailer enclosures. This technology does not reduce emissions when the vehicle is away from an electricity source.

Electrically-driven TRUs could, in the long term, be powered by fuel cells. This would allow the TRU to operate emission-free while enroute or when stopped at a facility, regardless of the availability of electricity. As previously mentioned, fuel cell technology for this application is not currently market-ready.

ARB is proposing to evaluate zero-emission TRU projects on a case-by-case basis. Criteria for other TRU projects are discussed in Chapter Four of the proposed Carl Moyer Program Guidelines.

G. Other Zero-Emission Projects

This appendix addresses some of the most likely zero-emission technology projects. It is by no means a complete list of zero-emission technology projects. Other zero-emission technology projects either require no special consideration (e.g., an internal combustion engine is directly replaced with an electric motor) or are described in the appropriate appendices (e.g., electric TRUs and power plug-in units to reduce locomotive idling). Zero-emission technology projects not specifically addressed in this

appendix or elsewhere in the proposed Guidelines may be considered for Carl Moyer Program funding on a case-by-case basis. As with all projects, emission reductions must be surplus, real, quantifiable, and enforceable and the project must meet the cost-effectiveness threshold of $5,000 per weighted ton.

ARB staff will continue to work closely with interested stakeholders to monitor technological developments in effort to determine when it may be appropriate to develop or modify criteria for zero-emission projects. If necessary, ARB will issue advisories to inform prospective applicants and districts of any new policy developments regarding Carl Moyer Program projects using zero-emission technologies.